

# Additions to the knowledge on the genus *Phintella* Strand, 1906 (Araneae, Salticidae, Chrysillini) from India

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## Abstract

Four new species of the chrysilline genus *Phintella* – *P. dentis* **sp. nov.** (♂♀), *P. handersoni* **sp. nov.** (♂♀), *P. luna* **sp. nov.** (♀) and *P. rajbharathi* **sp. nov.** (♂) – are described from India. Additionally, the unknown female of *Phintella platnicki* Sudhin, Sen & Caleb, 2023 is described and new distributional data are provided for this species. Notes on the type locality and distribution of *P. accentifera* (Simon, 1901) are provided along with clarification on the identity of other non-type materials. Detailed morphological descriptions, illustrations and a distributional map are also given.

## Key Words

China, distribution, jumping spider, new species, taxonomy, type locality, Vietnam

## Introduction

The jumping spider genus *Phintella* Strand, 1906, is one of the most diverse genera in the tribe Chrysillini which currently accommodates 71 described species, of which 14 have been described/reported from India (Caleb and Sankaran 2023). The members are small, adorned with colourful scales and are distributed in the African, Palearctic and Oriental Regions (World Spider Catalog 2023). Several new species were described in the past decade from East, South and Southeast Asia: 16 species from China (Barrion et al. 2013; Lei and Peng 2013; Huang et al. 2015; Cao et al. 2016; Li et al. 2019; Wang and Li 2020), three from India (Prajapati et al. 2021; Sudhin et al. 2023), two from Sri Lanka (Kanesharatnam and Benjamin 2019) and one from Vietnam (Hoang et al. 2023). While studying unidentified jumping spider collections from recent surveys across various locations in India, we recognised four new *Phintella* species. The paper thus aims to provide: (1) detailed descriptions of four new *Phintella* species from India; (2) first description of

the female of *P. platnicki* Sudhin, Sen & Caleb, 2023 and update of its distribution in India; (3) clarify the identity of previously misidentified species under *P. vittata* (C.L. Koch, 1846) and *P. accentifera* (Simon, 1902) from India, China and Vietnam; and (4) provide notes on the type locality and distribution of *P. accentifera*.

## Material and methods

A total of 42 *Phintella* specimens (17 ♂ and 25 ♀) preserved in 70% ethanol were studied and observed under a Leica M205A stereomicroscope. All measurements are given in millimetres (mm). Lengths of pedipalp and leg segments are given as follows: total [femur, patella, tibia, metatarsus (except for pedipalp), tarsus]. The description of colouration is based on alcohol-preserved specimens. The micrographic images were captured with a Flexacam C3 camera and processed using extended focus montage LAS X software. The description standard and style follows Sudhin et al. (2023). The distribution map was



prepared using the online mapping software SimpleMappr (Shorthouse 2010). The specimens are kept in the National Zoological Collections of the Zoological Survey of India (NZC-ZSI), Kolkata, India.

Abbreviations used in the text and figures are as follows: **ALE** – anterior lateral eye, **AME** – anterior median eye, **C** – cymbium, **CD** – copulatory duct, **CO** – copulatory opening, **do** – dorsal, **E** – embolus, **FD** – fertilisation duct, **LP** – lamellar process, **pl** – prolateral, **PLE** – posterior lateral eye, **PME** – posterior median eye, **plv** – prolateral ventral, **rl** – retrolateral, **RTA** – retrolateral tibial apophysis, **rlv** – retrolateral ventral, **SC** – scapum, **v** – ventral, **WLS** – Wildlife Sanctuary.

## Taxonomy

**Family Salticidae Blackwall, 1841**

**Tribe Chrysillini Simon, 1901**

**Genus *Phintella* Strand, 1906**

**Type species.** *Telamonia bifurcilinea* Bösenberg & Strand, 1906.

***Phintella dentis* Sudhin, Caleb & Sen, sp. nov.**

<https://zoobank.org/7C8320F0-A01B-4C97-B6FA-39F1DB73DA06>

Figs 1A–H, 2A–D, 4A–D, 14

**Type material.** *Holotype* ♂. INDIA: Karnataka, Shimoga District, Mookambika Wildlife Sanctuary, 13°42'24"N, 75°3'17"E, 629 m elev., 07.xii.2022, P.P. Sudhin coll. (NZC-ZSI-8369/18). *Paratype*: 1♀, same data as holotype (NZC-ZSI-8370/18).

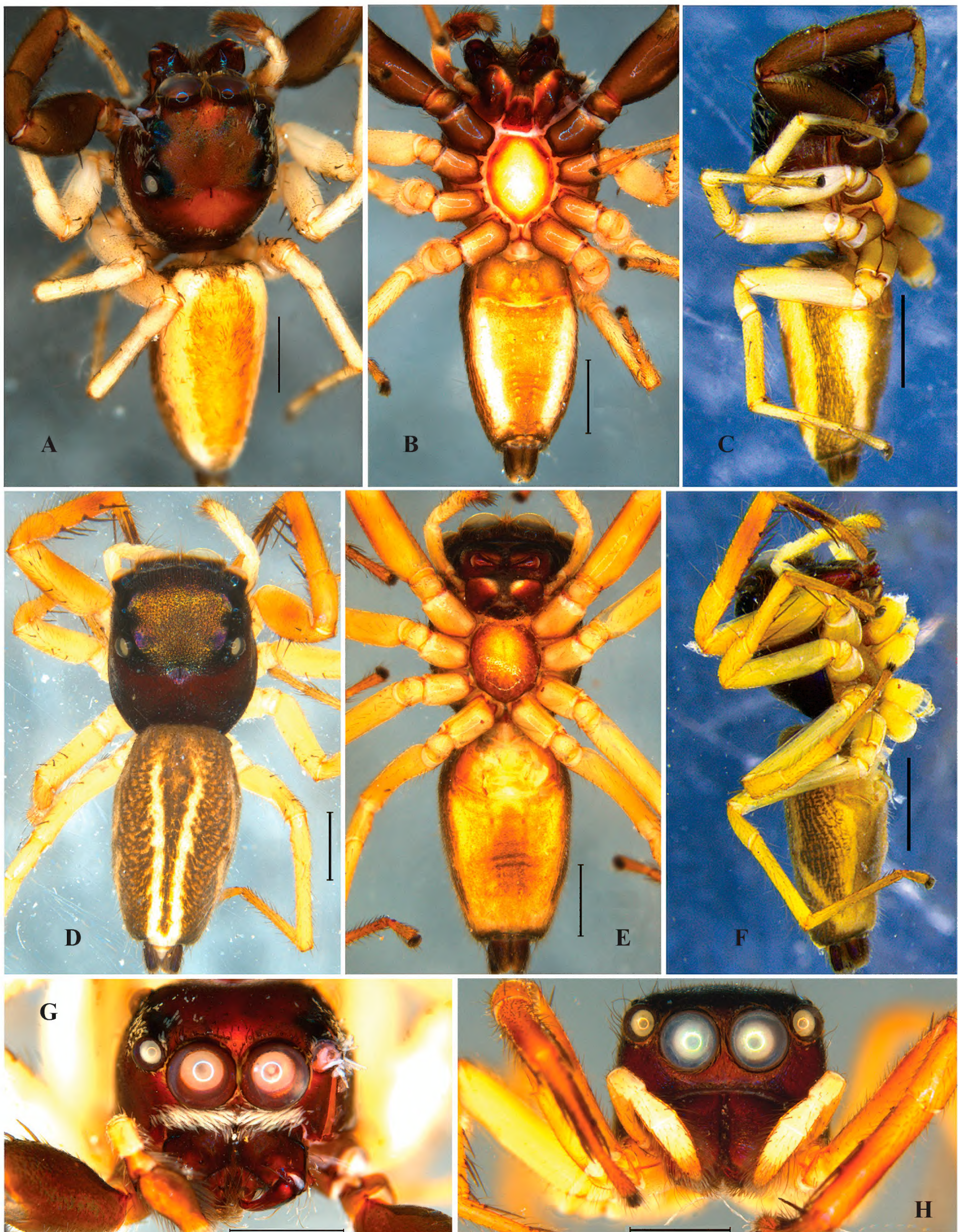
**Diagnosis.** The male copulatory organ of *P. dentis* sp. nov. is most similar to that of *P. jaleeli* Kanesharatnam & Benjamin, 2019, from which it can be distinguished by the following combination of characters: RTA robust without basal minute teeth (relatively narrower with basal minute teeth in *P. jaleeli*); embolus long and narrower, with the distal tip directed at 12 o'clock position in ventral view (short and robust with the distal tip directed at 1 o'clock position in *P. jaleeli*) (cf. Figs 2A, B, 4A, B with Figs 31D, E and 33A, B in Kanesharatnam and Benjamin (2019)). The female genitalia of *P. dentis* sp. nov. is most similar to that of *P. caledoniensis* Patoleta, 2009 from which it can be easily distinguished by the small copulatory openings, relatively short copulatory ducts and bilobed spermathecae (cf. Figs 2C, D, 4C, D with Figs 6–7 in Patoleta (2009)).

**Description. Male** (Holotype, NZC-ZSI-8369/18) (Figs 1A–C, G, 2A, B, 4A, B): Measurements: body length 4.26; carapace length 1.93, width 1.66; abdomen length 2.22, width 1.17. Ocular area length 1.44, width 1.23. Eye diameters: AME 0.51, ALE 0.23, PME 0.06, PLE 0.24. Eye interdistances: AME–AME 0.01, ALE–AME 0.02, ALE–ALE 1.03, ALE–PLE 0.53, PLE–PLE

1.11, PME–PME 1.18, PME–PLE 0.23. Clypeus height 0.15. Length of chelicera 0.47. Measurement of palp and legs: palp 1.57 [0.60, 0.21, 0.16, 0.60], leg I 4.01 [1.36, 0.62, 0.96, 0.67, 0.40], II 3.16 [1.03, 0.43, 0.74, 0.58, 0.38], III 3.71 [1.10, 0.48, 0.77, 0.86, 0.50], IV 4.23 [1.31, 0.44, 0.99, 0.96, 0.53]. Leg formula: 4132. Leg setation: femur I–III pl 1 rl 1 do 3, IV pl 1 rl 2 do 3; patella III–IV rl 1; tibia I plv 4 rlv 2, II pl 2 rl 2, III pl 1 rl 2 rlv 2, IV pl 2 rl 3 rlv 1; metatarsus I plv 2 rlv 2, II pl 1 rl 1 plv 2 rlv 2, III pl 2 rl 2 plv 2 rlv 3, IV pl 2 rl 2 plv 1 rlv 2. Carapace oval, high, sloping posteriorly, reddish-brown, covered with short white setae, margin of carapace with black lines (Fig. 1A); anterior region of thorax with a transverse diamond-shaped yellow-brown area behind eye field (Fig. 1A); eye field brown; eye bases black; AMEs surrounded by pale yellow setae (Fig. 1G). Clypeus short, reddish-brown, covered with white setae (Fig. 1G). Chelicerae small, sub-vertical, slightly diverging, reddish-brown, inner frontal face with tooth-like outgrowth, situated closer to base (Fig. 1B); chelicerae retromargin with two stout teeth with wide bases, arranged closely and transversely. Endites light brown, scopulate, with pale yellow inner margins; distal tip with beak-like curve (Fig. 1B). Labium light brown, distally pale yellow, covered with setae (Fig. 1B). Sternum oval, truncated anteriorly, pale yellow, with reddish-brown margins (Fig. 1B). Abdomen oval, narrowing posteriorly, pale yellow, laterally with longitudinal white stripes formed of white setae (Fig. 1A); lateral region dark brown (Fig. 1C); venter light brown, laterally with longitudinal white stripes and medially with a pair of yellowish dotted lines (Fig. 1B). Leg I brown with yellow metatarsi and tarsi (Fig. 1C), patella and tibia ventrally provided with brown setae; other leg articles pale yellow (Fig. 1C). Palps yellow-brown (Fig. 2A, B); RTA stout, directed anteriorly, wide at base, narrowing distally, tip slightly bent ventrally (Figs 2B, 4B); cymbium elongate oval, covered with long setae (Figs 2A, B, 4A, B); tegulum nearly rectangular with small U-shaped posterior lobe (Figs 2A, 4A); sperm duct visible on the retrolateral shoulder of tegulum (Figs 2A, 4A); embolus relatively long, situated anterior to bulbus, narrowing towards tip (Figs 2A, 4A).

**Female** (Paratype) (Figs 1D–F, H, 2C, D, 4C, D): Measurements: body length 4.63; carapace length 1.99, width 1.72; abdomen length 2.70, width 1.46. Ocular area length 1.26, width 1.50. Eye diameters: AME 0.48, ALE 0.25, PME 0.04, PLE 0.23. Eye interdistances: AME–AME 0.06, ALE–AME 0.05, ALE–ALE 1.01, ALE–PLE 0.58, PLE–PLE 1.07, PME–PME 1.16, PME–PLE 0.27. Clypeus height 0.16. Length of chelicera 0.65. Measurement of palp and legs: palp 1.43 [0.48, 0.16, 0.28, 0.51], leg I 4.84 [1.50, 0.66, 1.27, 0.84, 0.57], II 4.10 [1.35, 0.55, 0.92, 0.75, 0.53], III 4.44 [1.39, 0.67, 0.84, 1.03, 0.51], IV 4.92 [1.49, 0.55, 1.18, 1.16, 0.54]. Leg formula: 4132. Leg setation: femur I–IV pl 1 do 3; tibia I plv 4 rlv 4, II plv 3 rlv 3; metatarsus I plv 2 rlv 2, II pl 1 plv 2 rlv 2, III–IV pl 1 rl 1. In all details as male, except the following: carapace dark brown (Fig. 1D); eye field black,



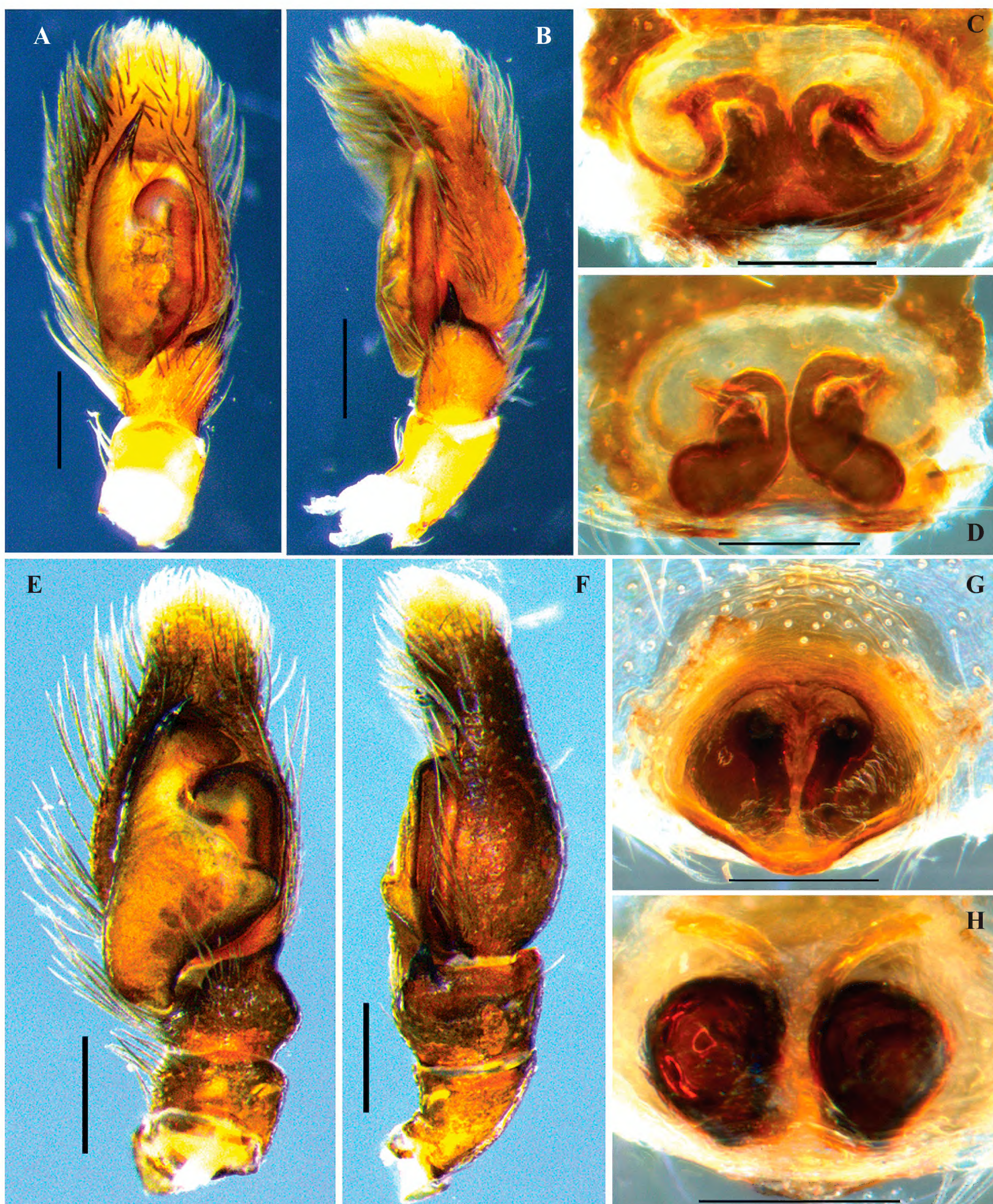


**Figure 1.** *Phintella dentis* sp. nov. **A.** Male, dorsal view; **B.** Same, ventral view; **C.** Same, lateral view; **D.** Female, dorsal view; **E.** Same, ventral view; **F.** Same, lateral view; **G.** Male, frontal view; **H.** Female, frontal view. Scale bars: 1 mm (A–H).

middle region decorated with shiny golden yellow patch (Fig. 1D); clypeus red-brown (Fig. 1H); chelicerae vertical, not diverging, reddish-brown, without any modification; cheliceral promargin with two teeth and retromargin

with a single tooth; endites yellowish-brown, without any modifications (Fig. 1E); labium brown (Fig. 1E); sternum nearly round, yellowish-brown with darker sides, margin with dark brown lines (Fig. 1E); abdomen brown





**Figure 2.** *Phintella dentis* sp. nov. (A–D) and *Phintella handersoni* sp. nov. (E–H). A, E. Left male palp, ventral view; B, F. Same, retrolateral view; C, G. Female epigyne, ventral view; D, H. Vulva, dorsal view. Scale bars: 0.2 mm (A–H).

with yellow patches, medially with two closely-arranged U-shaped pale yellow stripes extending longitudinally from below anterior margin to posterior end (Fig. 1D); abdomen dorso-laterally with thin yellow stripes, bending, moving to ventral margin and terminating just before spinnerets (Fig. 1F); abdomen lateral sides brown with thin yellow streaks (Fig. 1F); venter pale yellow with light brown middle region (Fig. 1E). Epigyne simple,

moderately sclerotised, wider than long (Figs 2C, 4C); copulatory openings small, widely separated from each other, situated antero-laterally (Figs 2C, 4C); copulatory ducts long, relatively narrow, sclerotised, anteriorly curved, leading posteriorly and connected to anterior part of spermathecae (Figs 2C, D, 4C, D); spermathecae bilobed, posterior lobe large and oval shaped, anterior lobe small and hump-shaped (Figs 2D, 4D); fertilisation ducts



orientated anterolaterally, located at the anterior region of spermathecae (Figs 2D, 4D).

**Etymology.** The species name is a noun in apposition originating from the Latin word ‘*dentis*’, meaning tooth and referring to the presence of a tooth-like outgrowth on the frontal face of the male chelicerae.

**Distribution.** Known only from the type locality in Karnataka, India (Fig. 14).

***Phintella handersoni* Sen, Sudhin & Caleb, sp. nov.**

<https://zoobank.org/CE3DD031-4FE5-4E09-BEDA-E34E7E24C038>

Figs 2E–H, 3A–H, 4E–H, 14

*Phintella accentifera*: Zabka 1985: 428, figs 430–434, 452 (♀); Xie, 1993: 358, figs 6–7 (♀); Peng et al. 1993: 150, figs 515–517 (♀); Song et al. 1999: 537, figs 307H, 327R (♀); Tyagi et al. 2019: supplement, figs S2.53 (♀); Peng 2020: 294, figs 209a–c (♀); Sudhin et al. 2023: 87, figs 24–27 (♀) (all misidentified).

*Phintella suavis*: Zabka 1985: 427, figs 426–429, 451 (♂); Peng et al. 1993: 160, figs 560–564; Song et al. 1999: 539, figs 308M–N (♂); Peng 2020: 307, figs 220a–e (♂) (all misidentified).

**Type material.** *Holotype* ♂. INDIA: Meghalaya, Ri Bhoi District, Anderson Tea Estate, 25°47'42"N, 91°53'03"E, 810 m elev., 13.iii.2023, S. Sen & P.P. Sudhin coll. (NZC-ZSI-8313/18). *Paratype*: 1♀, same data as holotype (NZC-ZSI-8371/18).

**Diagnosis.** *P. handersoni* sp. nov. is most similar to *Phintella accentifera* (Simon, 1901) in having the similar palpal and epigynal morphology, but it can be distinguished by the following combination of characters: abdominal pattern with dark brown and pale yellow transverse bands (without transverse bands, but with mid-dorsal chevron markings in *P. accentifera*); RTA conical and directed apically in retrolateral view (curved and directed ventrad in *P. accentifera*); tegulum with large lobe-like lamellar process (almost triangular in *P. accentifera*); embolus directed at 2 o'clock position in ventral view (3 o'clock position in *P. accentifera*); epigyne with distinct postero-medial protrusion (without any posterior projection in *P. accentifera*); copulatory ducts relatively narrow (broad in *P. accentifera*) (cf. Figs 2E–H, 3A, D, 4E–H with fig. 156 in Prószyński (1984) and figs 4.28A, D, E, G, I and J in Luong (2017)).

**Description.** **Male** (Holotype, NZC-ZSI-8313/18) (Figs 2E–F, 3A–C, G, 4E, F): Measurements: body length 3.72; carapace length 1.73, width 1.43; abdomen length 1.72, width 1.12. Ocular area length 1.05, width 1.21. Eye diameters: AME 0.41, ALE 0.22, PME 0.08, PLE 0.21. Eye interdistances: AME–AME 0.02, ALE–AME 0.03, ALE–ALE 0.83, ALE–PLE 0.53, PLE–PLE 0.89, PME–PME 0.98, PME–PLE 0.21. Clypeus height 0.22. Length of chelicera 0.78. Measurement of palp and legs: palp 1.69 [0.65, 0.21, 0.17, 0.66], leg I 3.67 [1.07, 0.59, 0.87, 0.78, 0.36], II 3.44 [1.13, 0.46, 0.78, 0.64, 0.43], III 4.01 [1.28, 0.47, 0.86, 0.91, 0.49], IV 4.41 [1.40, 0.46, 1.03, 1.05, 0.47]. Leg formula: 4312. Leg setation: femur I–II

pl 1 rl 1 do 3, III pl 1 rl 3 do 3, IV pl 1 rl 2 do 3; patella III–IV rl 1; tibia I pl 2 plv 4 rlv 4, II pl 2 rl 2 plv 4 rlv 4, III–IV pl 2 rl 2 plv 2 rlv 2; metatarsus I pl 1 rl 1 plv 2 rlv 2, II–III pl 2 rl 2 plv 2 rlv 2, IV pl 3 rl 3 plv 1 rlv 1. Carapace oval, high, sloping posteriorly, dark brown, anterior of thorax with a transverse diamond-shaped yellowish area behind eye field, margin of carapace with narrow black lines (Fig. 3A); eye field dark brown, anterior row of eyes encircled with pale yellow setae (Fig. 3G). Clypeus low, covered with silvery white setae (Fig. 3G). Chelicerae long, subvertical, diverging, yellowish-brown (Fig. 3G), promargin with two teeth and retromargin with a single tooth. Endites brown, scopulate, margins with narrow black lines (Fig. 3B). Labium brown, with paler tip, distally with dark brown setae (Fig. 3B). Sternum oval, anteriorly flat, dark brown with yellow dots, covered with white setae, lateral sides with more setae (Fig. 3B). Abdomen oval, dark brown, medially and posteriorly with transverse yellow bands (Fig. 3A); abdomen posteriorly with recurved yellow dotted lines and laterally with yellow and dark brown brick line patterns (Figs 3A, C); venter pale yellow medially with a light brown longitudinal band (Fig. 3B). Spinnerets pale yellow, covered with black setae. Legs brown, proximal region of metatarsus I, femora III and IV, metatarsi and tarsi II–IV pale yellow; all femora, patellae and tibiae covered with metallic lustrous setae, I–II with more lustrous setae. Palp brown (Fig. 2E, F); patella and tibia distal region with long black dorsal setae (Fig. 2E, F); tibia and patella covered with black setae (Fig. 2E, F); RTA short, stout, anteriorly directed, wide at base, slightly narrowing distally, tip slightly bent ventrally (Figs 2F, 4F); cymbium elongate oval, covered with long brown setae (Figs 2E, F, 4E, F); tegulum with well-developed posterior lobe (Figs 2E, 4E); lamellar process large, almost cone-shaped (Figs 2E, 4E); tegulum with conspicuous retrolateral shoulder, sperm duct visible at this shoulder (Figs 2E, 4E); embolus short, situated anterior to bulbus, narrowing tip directed at 2 o'clock position in ventral view (Figs 2E, 4E).

**Female** (Paratype) (Figs 2G, H, 3D–F, H, 4G, H): Measurements: body length 4.24; carapace length 1.68, width 1.32; abdomen length 2.15, width 1.67. Ocular area length 1.01, width 1.22. Eye diameters: AME 0.46, ALE 0.23, PME 0.04, PLE 0.23. Eye interdistances: AME–AME 0.03, ALE–AME 0.05, ALE–ALE 0.88, ALE–PLE 0.57, PLE–PLE 1.06, PME–PME 1.13, PME–PLE 0.27. Clypeus height 0.08. Length of chelicera 0.56. Measurement of palp and legs: palp 1.31 [0.47, 0.16, 0.25, 0.43], leg I 2.77 [0.87, 0.36, 0.68, 0.54, 0.32], II 2.65 [0.88, 0.38, 0.57, 0.50, 0.32], III 3.21 [1.02, 0.39, 0.65, 0.73, 0.42], IV 3.73 [1.17, 0.40, 0.85, 0.87, 0.44]. Leg formula: 4312. Leg setation: femur I–III pl 2 rl 1 do 3, IV pl 1 rl 1 do 3; patella III–IV rl 1; tibia I pl 1 rl 1 plv 2 rlv 2, II pl 2 rl 1 plv 3 rlv 3, III–IV pl 2 rl 3 plv 2 rlv 1; metatarsus I pl 1 rl 1 plv 2 rlv 2, II pl 2 rl 2 plv 3 rlv 3, III pl 2 rl 2 plv 3 rlv 3, IV pl 3 rl 3 plv 1 rlv 1. In all details as male, except the following: eye field black (Fig. 3D); chelicerae small, vertical, yellowish-brown with darker dorsal side



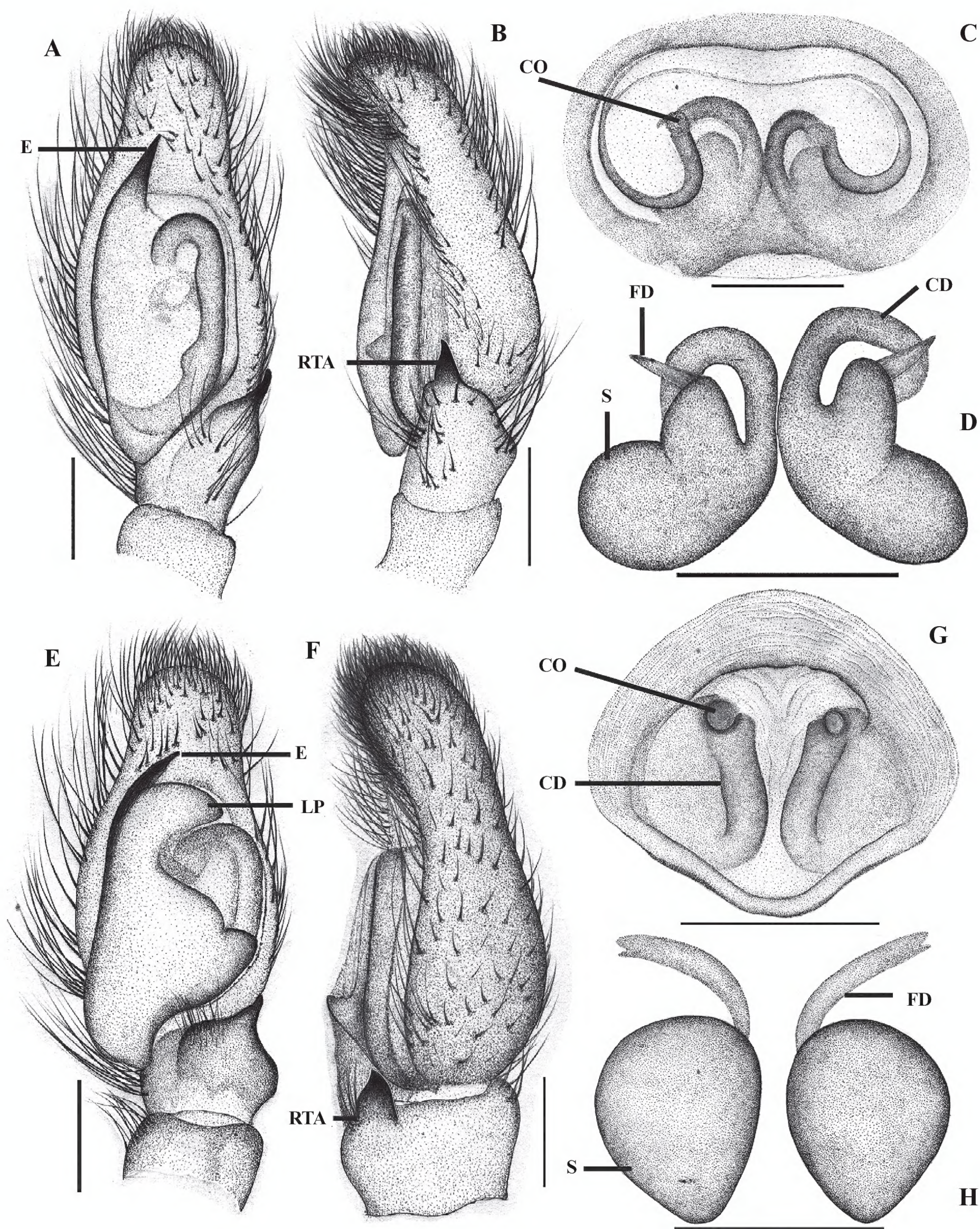


**Figure 3.** *Phintella handersoni* sp. nov. **A.** Male, dorsal view; **B.** Same, ventral view; **C.** Same, lateral view; **D.** Female, dorsal view; **E.** Same, ventral view; **F.** Same, lateral view; **G.** Male, frontal view; **H.** Female, frontal view. Scale bars: 1 mm (A–H).

(Fig. 3H); endites dark brown with pale yellow inner tips (Fig. 3E); labium dark brown (Fig. 3E); abdomen light brown with faint medial transverse band (Fig. 3D);

venter with prominent, lens-shaped longitudinal median brown band (Fig. 3E). Epigyne wider than long, sclerotised, with wide, curved posterior margin (Figs 2G, 4G);





**Figure 4.** *Phintella dentis* sp. nov. (A–D) and *Phintella handersoni* sp. nov. (E–H). A, E. Left male palp, ventral view; B, F. Same, retrolateral view; C, G. Female epigyne, ventral view; D, H. Vulva, dorsal view. Scale bars: 0.2 mm (A–H).

copulatory openings round, separated from each other, situated anterior region of epigyne (Figs 2G, 4G); copulatory ducts highly sclerotised, slightly curved, extending posteriorly and entering at posterior part of spermathecae (Figs 2G, 4G); spermathecae nearly pear-shaped, separated from each other (Figs 2H, 4H); fertilisation

ducts long, orientated anterolaterally, located at anterior region of spermathecae (Figs 2H, 4H).

**Etymology.** The species is named after the late Handerson Syiemlieh, the owner of the tea estate from where the type series was collected.



**Distribution.** India (Assam, Manipur, Meghalaya) (Fig. 14), China and Vietnam.

**Remarks.** Since both sexes were collected together in this study, it was possible for us to determine the identity as we compared them with previous illustrations and with those of the type images (Luong 2017) of both *P. accentifera* and *P. suavis*. The general colour pattern of the female which was earlier identified as *P. accentifera* did not match with the type, thus leading us to re-verify all previous illustrations. On the other hand, it was concluded that *P. suavis* was a synonym of *P. vittata* (Luong 2017: 104). We agree with Luong's conclusion on the synonymy, based on the images of the type specimens; however, that decision has not been made formally yet. Based on these observations, we concluded that this species was misidentified earlier and each sex was assigned to different names by previous scientists. Zabka (1985) illustrated the male as *P. suavis* and the female as *P. accentifera* from Vietnam. This was followed by Chinese (Peng et al. 1993; Xie 1993; Song et al. 1999; Peng 2020) and Indian authors (Tyagi et al. 2019; Sudhin et al. 2023). Two females from Assam (Tyagi et al. 2019: GenBank accession numbers [MK392820](#) and [MK392821](#)) and two females from Manipur (Sudhin et al. 2023) were misidentified as *P. accentifera*.

Simon (1901) does not provide the exact locality for *P. accentifera* (Simon, 1901); however, mentions, “et dans les espèces des montagnes de l'Inde, *T. accentifera* E. Sim.” (“and in the species of the mountains of India, *T. accentifera* E. Sim.” – Simon, (1901: 548)). Luong (2017) examined the syntypes of *P. accentifera* deposited in the Muséum national d'Histoire naturelle, Paris and precisely designated the lectotype, based on a specimen from Kodaikanal (a hill station in South India) from the vial No. 10254. Nevertheless, the designation of lectotype and paralectotypes has not yet been formally published. Nevertheless, based on the information from the original description of Simon (1901) and the type label (Luong 2017: fig. 4.28K), the type locality of *P. accentifera* is, thus, Kodaikanal in Tamil Nadu, India. *P. accentifera* (Simon, 1901) is presently confined to its type locality in South India.

***Phintella luna* Sudhin, Sen & Caleb, sp. nov.**

<https://zoobank.org/08B77287-5B14-4BE9-BFE3-2E69D999BD4F>

Figs 5A–E, 6A, B, 14

*Phintella vittata* Tyagi et al., 2019: supplement, figs S3.29–30 (♀ misidentified).

**Type material.** *Holotype* ♀. INDIA: West Bengal, Nadia District, Kalyani, 22°59'6.54"N, 88°26'0.06"E, 17.ix.1969, D. Sinharney coll. (NZC-ZSI-6559/18); *Paratype*: 1♀, Andhra Pradesh, East Godavari District, Kittukuru, 17°19'16.5"N, 82°2'26.55"E, 05.xii.2021, D. Jaiswal coll. (NZC-ZSI-8374/18).

**Diagnosis.** *P. luna* sp. nov. is similar to *Phintella vittata* (C.L. Koch, 1846) in having the similar body colour patterns and female genitalia with well-developed epigynal scape and rounded spermathecae, but it can be distinguished by the following characters: epigyne with straight anterior epigynal border (arched in *P. vittata*); copulatory ducts gently curved, U-shaped and relatively longer (straight, converging posteriorly, V-shaped in *P. vittata*) (cf. Figs 5D, 6A with Figs 12G, 13C).

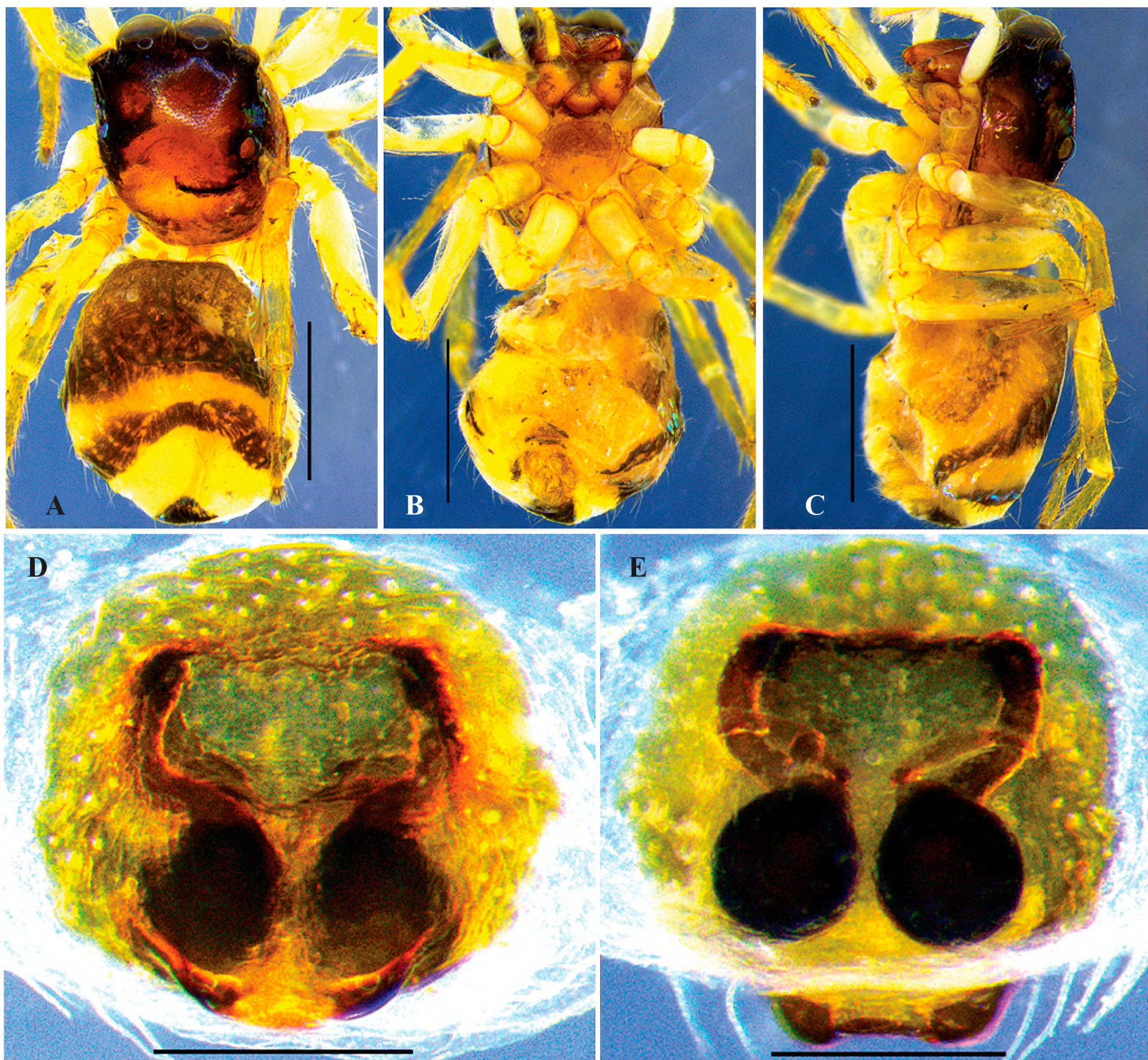
**Description. Female** (Holotype, NZC-ZSI-6559/18) (Figs 5A–E, 6A, B): Measurements: body length 2.92; carapace length 1.24, width 1.07; abdomen length 1.60, width 1.25. Ocular area length 0.82, width 0.94. Eye diameters: AME 0.35, ALE 0.18, PME 0.03, PLE 0.16. Eye interdistances: AME–AME 0.02, ALE–AME 0.02, ALE–ALE 0.73, ALE–PLE 0.37, PLE–PLE 0.77, PME–PME 0.81, PME–PLE 0.17. Clypeus height 0.06. Length of chelicera 0.43. Measurement of palp and legs: palp 1.18 [0.43, 0.15, 0.20, 0.40], leg I 2.37 [0.76, 0.34, 0.55, 0.44, 0.28], II 2.13 [0.76, 0.23, 0.52, 0.36, 0.26], III 2.77 [0.89, 0.30, 0.60, 0.67, 0.31], IV 3.23 [1.02, 0.32, 0.75, 0.78, 0.36]. Leg formula: 4312. Leg setation: femur I–IV pl 1 rl do 3; patella III–IV rl 1; tibia I pl 1 plv 3 rlv 3, II pl 2 rl 2 plv 2 rlv 2 III pl 1 rl 1 plv 2 rlv 1, IV pl 1 rl 2 plv 1 rlv 1; metatarsus I pl 1 rl 1 plv 2 rlv 2, II pl 2 rl 2 plv 2 rlv 2, III–IV pl 2 rl 2 plv 1 rlv 1. Carapace oval, sloping posteriorly, light yellowish-brown, with few black patches and stripes (Fig. 5A); eye bases black (Fig. 5A), anterior eyes surrounded by pale white setae. Clypeus low, light yellowish-brown. Chelicerae small, vertical, yellow-brown, promargin with two teeth and retromargin with a single tooth. Endites pale yellow, scopulate, margins with narrow reddish-brown lines (Fig. 5B). Labium pale yellow, distally with few light brown setae (Fig. 5B). Sternum yellowish-brown, with pale yellow posterior sides (Fig. 5B). Abdomen oval, pale yellow with light brown anterior region, medially with a dark brown transverse band and posterior tip with a dark brown patch (Fig. 5A). Venter pale yellow without any prominent markings (Fig. 5B). Legs pale yellow. Epigyne nearly round, moderately sclerotised, posterior region with well-developed epigynal scape (Figs 5D, 6A); copulatory openings small, widely separated from each other, situated antero-laterally (Figs 5D, 6A); copulatory ducts comparatively long, gently curved and connected to anterior region of spermathecae (Figs 5D, 6A); spermathecae nearly round, separated from each other (Figs 5E, 6B); fertilisation duct long, orientated laterally, located at anterior region of spermathecae (Figs 5E, 6B).

**Male.** Unknown.

**Etymology.** The specific epithet is noun in apposition, referring to the curved, crescent-like copulatory ducts ('luna' in Latin for the moon). We also take this occasion to mark the successful landing of the spacecraft Chandrayaan-3 close to the South Pole of the moon for the first time during the third Indian lunar expedition.

**Distribution.** India: West Bengal, Andhra Pradesh, and Gujarat (Tyagi et al. 2019) (Fig. 14).





**Figure 5.** *Phintella luna* sp. nov. **A.** Female, dorsal view; **B.** Same, ventral view; **C.** Same, lateral view; **D.** Female epigyne, ventral view; **E.** Vulva, dorsal view. Scale bars: 0.5 mm (A–C); 0.2 mm (D–E).

**Remarks.** A specimen previously identified as *P. vittata* from Gujarat (Tyagi et al. 2019) has been listed here as belonging to this species. The epigyne of this specimen has a longitudinal groove on the ventral surface, present at the mid-line just below the spermathecae. The spermathecae are also comparatively wider than the type illustrated here. The scape is similar to that of the holotype of *Saliticus ranjitus* Tikader, 1967 (a synonym of *Phintella vittata*) (cf. fig. S3.29 in Tyagi et al. (2019) with Fig. 13C herein).

***Phintella rajbharathi* Caleb, Sudhin & Sen, sp. nov.**

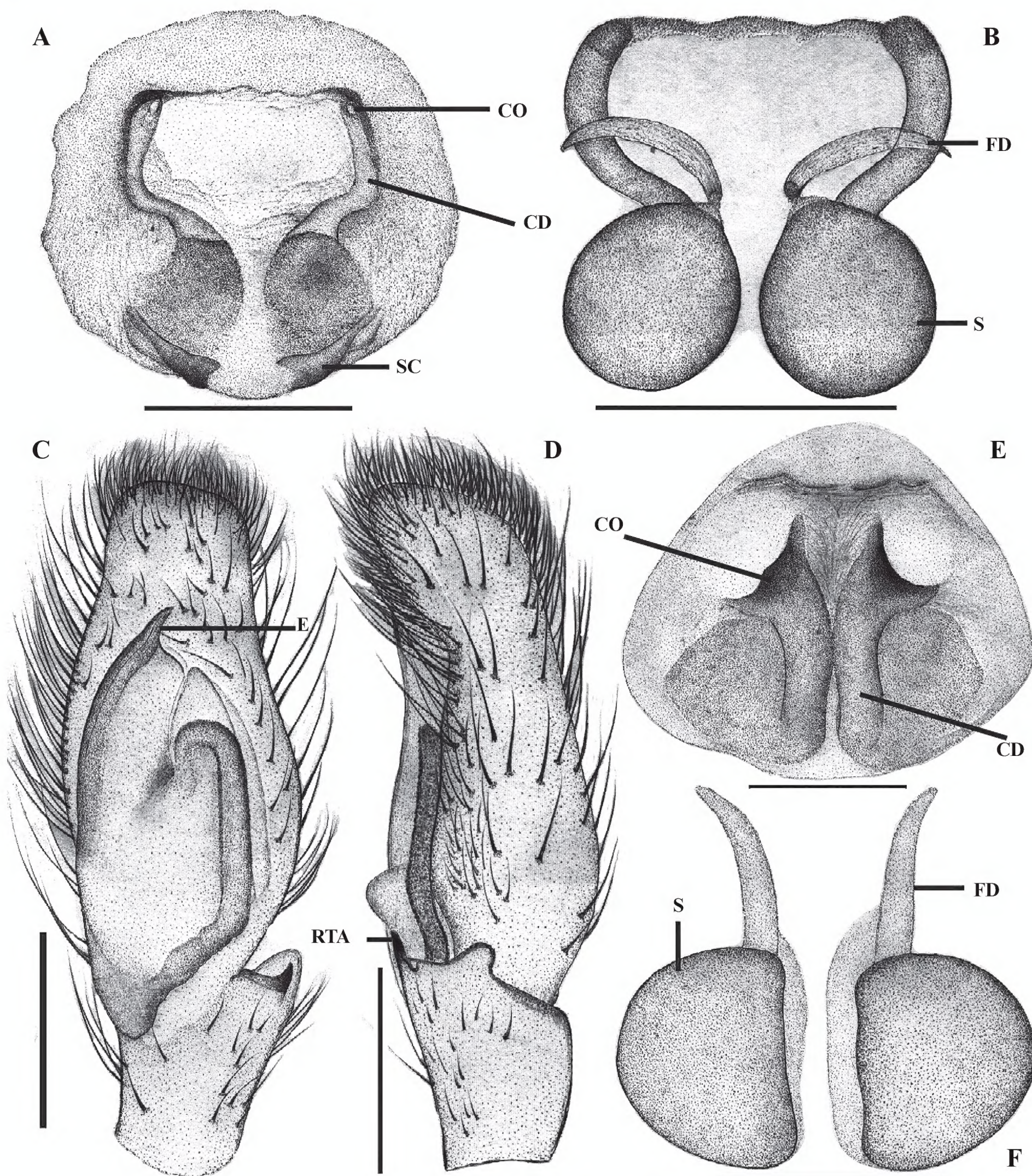
<https://zoobank.org/8FF8C587-E536-44E9-BD1F-9D4995FE3E1F>  
Figs 6C, D 7A–D, 8A–G, 14

**Type material.** *Holotype* ♂. INDIA: Tamil Nadu, Coimbatore, 10°59'49.71"N, 76°59'8.27"E, 415 m elev., 19.vi.2022, Raj Bharathi coll. (NZC-ZSI-8375/18).

**Diagnosis.** *P. rajbharathi* sp. nov. can be easily distinguished from those of all other *Phintella* species by the morphology of the tibial apophyses: ventral apophysis relatively short and thin and thorn-like, dorsal apophysis small and hump-shaped (Figs 6D, 8G).

**Description.** **Male** (Holotype, NZC-ZSI-8375/18) (Figs 6C, D, 7A–D, 8A–G): Measurements: body length 3.99; carapace length 1.84, width 1.72; abdomen length 2.15, width 1.17. Ocular area length 0.95, width 1.38. Eye diameters: AME 0.44, ALE 0.23, PME 0.07, PLE 0.22. Eye interdistances: AME–AME 0.02, ALE–AME 0.03, ALE–ALE 0.92, ALE–PLE 0.56, PLE–PLE 1.03, PME–PME 1.13, PME–PLE 0.23. Clypeus height 0.04. Length of chelicera 0.52. Measurement of palp and legs: palp 1.71 [0.64, 0.25, 0.18, 0.64], leg I 5.17 [1.60, 0.97, 1.19, 1.00, 0.41], II 3.21 [0.98, 0.58, 0.62, 0.69, 0.34], III 3.82 [1.23, 0.54, 0.74, 0.93, 0.38], IV 4.31 [1.31, 0.57, 0.93, 1.09, 0.41]. Leg formula: 1432. Leg setation: femur





**Figure 6.** *Phintella luna* sp. nov. (A, B), *Phintella rajbharathi* sp. nov. (C, D) and *Phintella platnicki* Sudhin, Sen & Caleb, 2023 (E, F). A, E. Female epigyne, ventral view; B, F. Vulva, dorsal view; C. Left male palp, ventral view; D. Same, retrolateral view. Scale bars: 0.2 mm (A, B, E, F); 0.25 mm (C, D).

I pl 1 do 3, II–III pl 1 rl 1 do 3, IV pl 2 rl 1 do 3; patella III–IV rl 1; tibia plv 4 rlv 2, II plv 2 rlv 2, III pl 1 rl 2 rlv 2, IV pl 2 rl 3 rlv 1; metatarsus I plv 2 rlv 2, II pl 1 rl 1 plv 2 rlv 2, III pl 2 rl 2 plv 2 rlv 3, IV pl 2 rl 2 plv 2 rlv 2. Carapace oval, high, sloping posteriorly, pale yellowish-brown, covered with brown setae (Fig. 8A); carapace margin with narrow brown lines; eye field densely covered with pale yellow setae, eye bases black, anterior eyes

surrounded by pale yellow setae (Fig. 8A, D). Clypeus low, light yellowish-brown, covered with a row of medium-sized light brown setae (Fig. 8D). Chelicerae subvertical, slightly diverging, light yellow to brown, dorsally with a conspicuous bump near fang base (Fig. 8D); promargin with two teeth, one stout with wide base and other small, retromargin with a single tooth with wide base; chelicerae ventrally with a widely curved ridge (Fig. 8E).





**Figure 7.** *Phintella rajbharathi* sp. nov. **A.** Male, dorsal view; **B.** Same, lateral view; **D, E.** Same, frontal view. Photo credit **A–D:** Raj Bharathi.

Endites scopulate, light yellowish-brown with paler inner sides, margins with black lines (Fig. 8B). Labium yellow brown, with paler tip, distally with light brown setae; with a vertical ridge extending from base to mid-region and a tooth-like bump above it (Fig. 8B). Sternum oval, anteriorly flat, yellow, with light brown margin (Fig. 8B). Abdomen elongate oval, narrowing posteriorly, yellow, laterally with brown longitudinal stripes extending along entire length of abdomen (Fig. 8A,C); venter pale white without any prominent markings (Fig. 8B). Spinnerets light brown with paler tips, covered with light brown setae. Leg I brown with pale yellow metatarsi and tarsi; leg I ventral region provided with short and stout macrosetae; other leg articles pale yellow. Palp yellowish-brown (Figs 8F, G); tibia with two RTA, ventral one short, thin and dorsal one like a hump (Figs 6D, 8G); cymbium elongate oval, covered with long brown setae (Figs 6C, D, 8F–G); posterior lobe small, straight, directed posteriorly with blunt end (Figs 6C, 8F); tegulum with small conical protuberance retrolaterally, sperm duct visible at this shoulder (Figs 6C, 8F); embolus short, situated anterior to bulbus, tip directed at 1 o'clock position in ventral view (Figs 6C, 8F).

**Female.** Unknown

**Etymology.** The species is named after the collector of the holotype – Raj Bharathi. The name is treated as a noun in apposition.

**Distribution.** Known only from the type locality (Fig. 14).

#### *Phintella platnicki* Sudhin, Sen & Caleb, 2023

Figs 6E–F, 9A–H, 10A–D, 11A–H, 14

*Phintella platnicki* Sudhin, Sen & Caleb, 2023: 76, figs 16–23 (♂, examined).

**Type material.** *Holotype* male from INDIA: Tamil Nadu: Salem, Yercaud (10°46'13.95"N, 78°12'6.37"E), 18.x.2019, J. Thilak coll. (NZC-ZSI-7352/18).

**Material examined.** INDIA: Karnataka: Mookambika Wildlife Sanctuary, Kodachadri, 14♀♀ & 8♂♂, 13°51'25.51"N, 74°52'2.03"E, 1330 m elev., 01.xii.2022, P. P. Sudhin coll. (NZC-ZSI-8376/18). Kerala: Idukki, Kuttikkanam, 7♀♀ & 6♂♂, 9°33'38.44"N, 77°1'2.99"E, 1106 m elev., 24.i.2023, P. Girish Kumar coll. (NZC-ZSI-8377/18).

**Diagnosis.** The female epigyne of *P. platnicki* Sudhin, Sen & Caleb, 2023, is most similar to that of *Phintella nilgirica* Prószyński, 1992, from which it can be easily distinguished by the broad, funnel-shaped copulatory openings (relatively small and round in *P. nilgirica*) and parallel copulatory ducts (separated, sub-parallel in *P. nilgirica*) (cf. Figs 6E, F, 11C, D, G, H with figs 61–62 in Prószyński (1992)). For the diagnosis of male, see Sudhin et al. (2023).

**Description. Male.** See Sudhin et al. (2023)

**Female** (NZC-ZSI-8376-77/18) (Figs 6E, F, 9A–H, 10A–D, 11A–H): Measurements: body length 5.64;





**Figure 8.** *Phintella rajbharathi* sp. nov. **A.** Male, dorsal view; **B.** Same, ventral view; **C.** Same, lateral view; **D.** Same, frontal view; **E.** Chelicerae, ventral view; **F.** Left male palp, ventral view; **G.** Same, retrolateral view. Scale bars: 1 mm (**A–C**); 0.8 mm (**D**); 0.3 mm (**E**); 0.25 mm (**F, G**).

carapace length 2.09, width 1.52; abdomen length 3.05, width 1.31. Ocular area length 0.95, width 1.31. Eye diameters: AME 0.42, ALE 0.23, PME 0.04, PLE 0.20. Eye interdistances: AME–AME 0.04, ALE–AME 0.03, ALE–ALE 0.89, ALE–PLE 0.50, PLE–PLE 0.98, PME–PME 1.08, PME–PLE 0.20. Clypeus height 0.20.

Length of chelicera 0.72. Measurement of palp and legs: palp 1.80 [0.64, 0.22, 0.34, 0.60], leg I 3.81 [1.16, 0.60, 0.87, 0.70, 0.48], II 3.59 [1.17, 0.51, 0.79, 0.66, 0.46], III 4.24 [1.39, 0.45, 0.85, 0.93, 0.62], IV 5.12 [1.57, 0.63, 1.13, 1.24, 0.55]. Leg formula: 4312. Leg setation: femur I pl 1 do 3, II– III pl 1 rl 1 do 3, IV rl 1 do 3;





**Figure 9.** *Phintella platnicki* Sudhin, Sen & Caleb, 2023, from Karnataka. **A.** Male, dorsal view; **B.** Same, ventral view; **C.** Same, lateral view; **D.** Female, dorsal view; **E.** Same, ventral view; **F.** Same, lateral view; **G.** Male, frontal view; **H.** Female, frontal view. Scale bars: 1 mm (A–H).

patella III–IV rl 1; tibia I–II pl 2 rl 1 plv 4 rlv 4, III pl 2 rl 2 plv 1 rlv 1, IV pl 2 rl 3 plv 2 rlv 1; metatarsus I–II pl 1 rl 1 plv 2 rlv 2, II pl 2 rl 2 plv 2 rlv 2, III pl 2 rl 2

plv 1 rlv 2, IV pl 3 rl 3 plv 1 rlv 2. Carapace oval, high, sloping posteriorly, pale yellow, covered with short pale white and dark brown setae (Fig. 9D); thoracic region





**Figure 10.** *Phintella platnicki* Sudhin, Sen & Caleb, 2023, from Kerala. **A.** Male, dorsal view; **B.** Female, dorsal view; **C.** Male, frontal view; **D.** Female, frontal view. Scale bars: 1 mm (A–D).

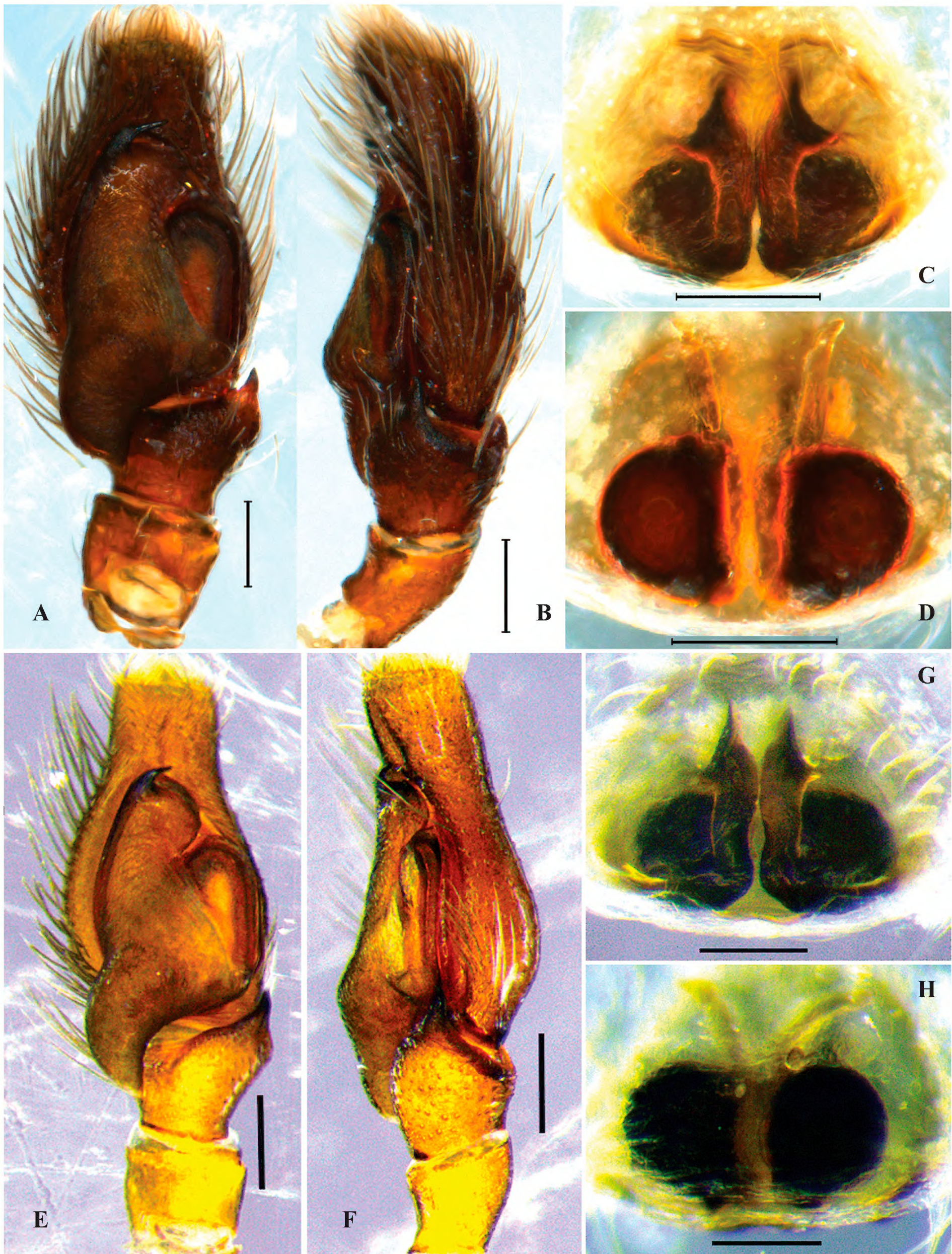
dorsally with two broad dark brown longitudinal stripes (Fig. 9D); margin of carapace with narrow black lines; eye field pale yellow to brown, eye bases black, anterior eyes surrounded by pale yellow orbital setae (Fig. 9D, H). Clypeus low, pale yellow, covered with pale white setae (Fig. 9H). Chelicerae small, yellowish-brown (Fig. 9H), promargin with two teeth and retromargin with a single tooth. Endites pale yellow to yellow, scopulate (Fig. 9E). Labium light-brown, with paler tip, distally with dark brown setae (Fig. 9E). Sternum oval, pale white (Fig. 9E). Abdomen elongate oval, narrowing posteriorly, pale yellow, dorsally with a pair of broad lateral longitudinal light brown bands extending along entire length (Fig. 9D); abdomen lateral sides with irregular light brown longitudinal streaks and patches (Fig. 9F); venter pale yellow, medially with broad light brown longitudinal band and sides with irregular light brown patches (Fig. 9E). Spinnerets light brown. Legs pale yellow with black pro- and retrolateral mottling on

proximal and distal areas of tibiae I and distal areas of tibiae II. Epigyne simple, moderately sclerotised, nearly apple-shaped, covered with white setae (Figs 6E, 11C, G); copulatory openings broad, funnel-shaped, antero-laterally orientated (Figs 6E, 11C, G); copulatory ducts long, highly sclerotised, slightly curved anteriorly, running parallel along mid-longitudinal axis and then connected to posterior part of spermathecae (Figs 6E, 11C, G); spermathecae highly sclerotised, nearly semi-circular in shape, separated from each other (Figs 6F, 11D, H); fertilisation ducts long, orientated anteriorly, located at anterior region of spermathecae (Figs 6F, 11D, H).

**Distribution.** India: Type locality – Tamil Nadu. New records from Karnataka and Kerala (Fig. 14).

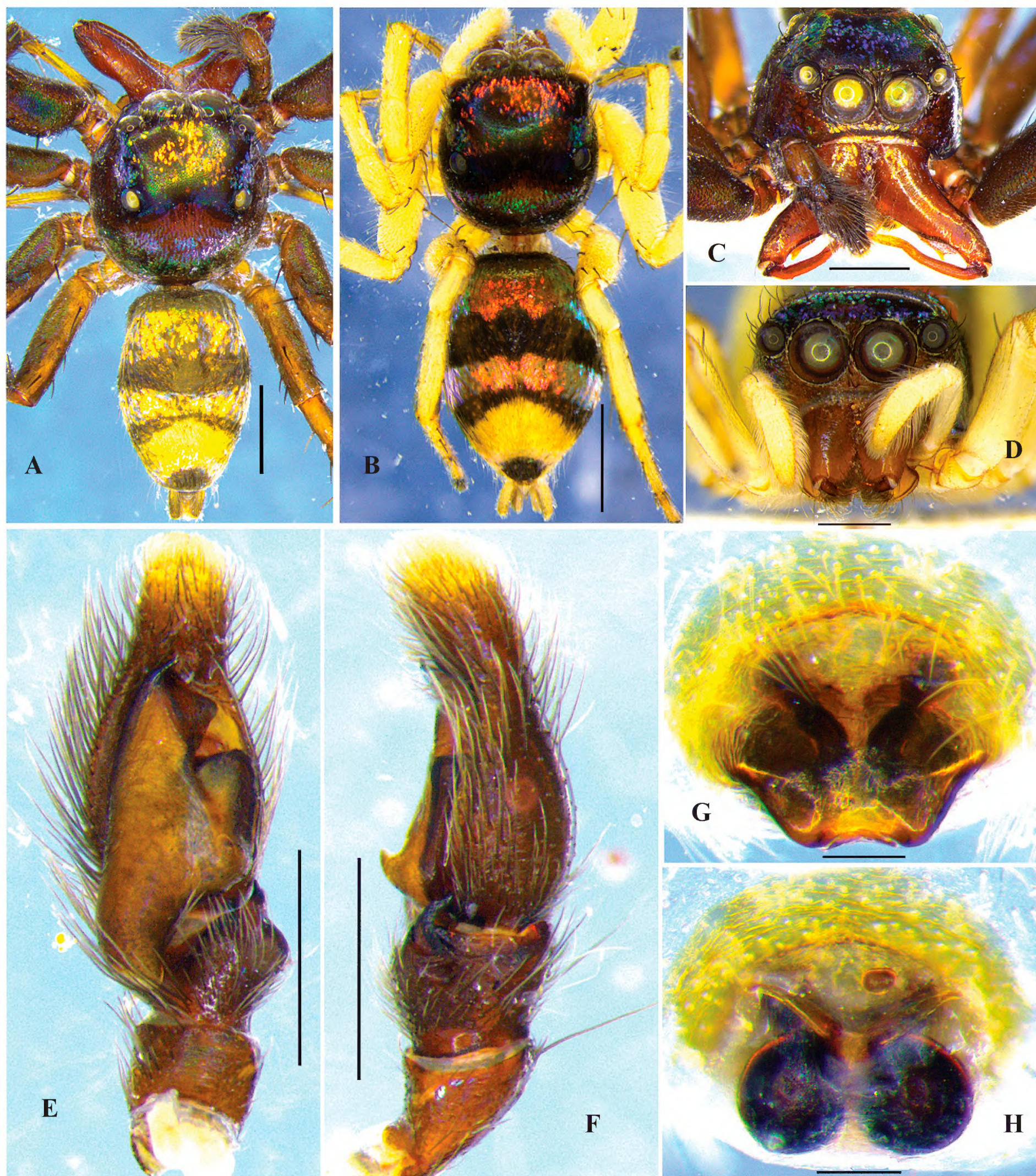
**Variation.** Both sexes of the species have been collected from new localities in south India. Darker and lighter forms have been found in the collections and the variation in the colour pattern of the female have also been illustrated in Figs 9A–H, 10A–D, 11A–H.





**Figure 11.** *Phintella platnicki* Sudhin, Sen & Caleb, 2023, from Karnataka (A–D) and from Kerala (E–H). A, E. Left male palp, ventral view; B, F. Same, retrolateral view; C, G. Female epigyne, ventral view; D, H. Vulva, dorsal view. Scale bars: 0.2 mm (A–F); 0.1 mm (G–H).





**Figure 12.** *Phintella vittata* (C. L. Koch, 1846). **A.** Male, dorsal view; **B.** Female, dorsal view; **C.** Male, frontal view; **D.** Female, frontal view; **E.** Left male palp, ventral view; **F.** Same, retrolateral view; **G.** Female epigyne, ventral view; **H.** Vulva, dorsal view. Scale bars: 1 mm (**A, B**); 0.5 mm (**C–F**); 0.1 mm (**G–H**).

## Discussion

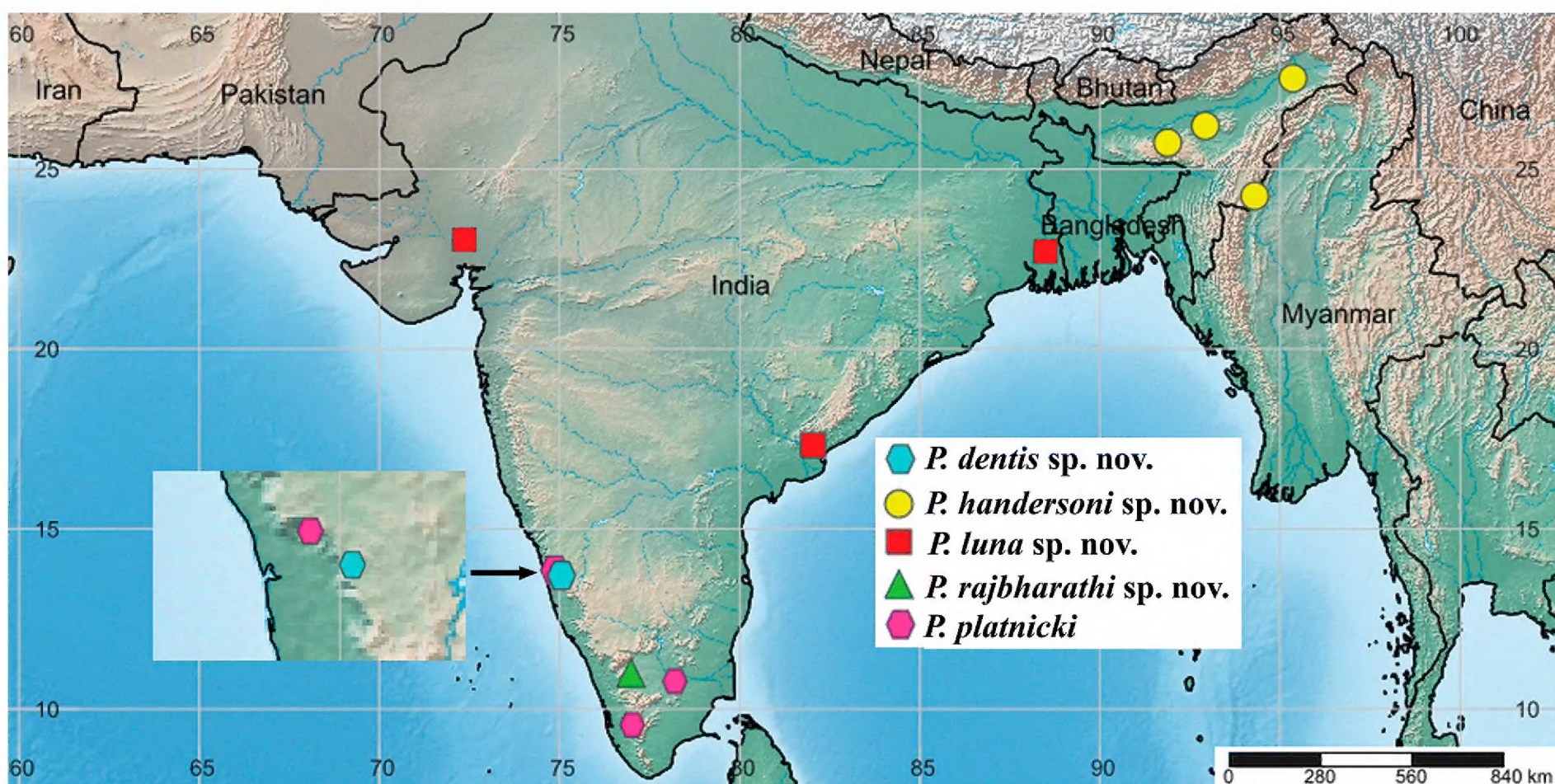
The present work deals with the description of four new species of the genus *Phintella* Strand, 1906 from India. With the addition of these new species, the total number of *Phintella* species known in India increases from 14 to 18 (Caleb and Sankaran 2023). India has the second highest number of *Phintella* species ever recorded in a single country after China (World Spider Catalog 2023). Sudhin et al. (2023) observed that Indian *Phintella* spe-

cies are mainly reported from the southern and eastern regions of the country, except for *P. cholkei* Prajapati, Kumbhar, Caleb, Sanap & Kamboj, 2021 and *P. vittata* (C. L. Koch, 1846), both of which occur in the western region. In the present study, *P. dentis* sp. nov., *P. handersoni* sp. nov., *P. rajbharathi* sp. nov. and *P. platnicki* Sudhin, Sen & Caleb, 2023 are reported from the southern or eastern regions of the country, while *P. luna* sp. nov. is being reported from both the western and eastern regions (Fig. 14). However, the exact diversity and distribution of





**Figure 13.** *Phintella vittata* (C. L. Koch, 1846) (Holotype of *Salticus ranjitus* Tikader, 1967). **A.** Female, dorsal view; **B.** Same, ventral view; **C.** Female, epigyne, ventral view. Scale bars: 1 mm (**A, B**); 0.25 mm (**C**).



**Figure 14.** Distributional map of *Phintella* species dealt in this study.

the genus in India remains unclear and must await more comprehensive surveys covering underexplored areas particularly the central and northern regions in India.

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## References

- Barrion AT, Barrion-Dupo ALA, Catindig JLA, Villareal MO, Cai D, Yuan QH, Heong KL (2013) New species of spiders (Araneae) from Hainan Island, China. UPLB Museum Publications in Natural History 3: 1–103. <https://doi.org/10.5281/zenodo.269136>
- Caleb JTD, Sankaran PM (2023) Araneae of India. Version 2023. <http://www.indianspiders.in> [accessed on 13 September 2023]
- Cao Q, Li SQ, Żabka M (2016) The jumping spiders from Xishuangbanna, Yunnan, China (Araneae, Salticidae). ZooKeys 630: 43–104. <https://doi.org/10.3897/zookeys.630.8466>
- Hoang QD, Tran HPT, Vu TB, Pham PT (2023) A new species and a new record of the jumping spider genus *Phintella* Strand, 1906 (Araneae: Salticidae) from the Central Highlands of Vietnam. Bonn Zoological Bulletin 72(1): 145–150. <https://doi.org/10.20363/BZB-2023.72.1.145>
- Huang Y, Wang C, Peng XJ (2015) Five new species of *Phintella* Strand, 1906 (Araneae: Salticidae) from the Wuling Mountains, China. ZooKeys 514: 25–42. <https://doi.org/10.3897/zookeys.514.9159>
- Kanesharatnam N, Benjamin SP (2019) Multilocus genetic and morphological phylogenetic analysis reveals a radiation of shiny South Asian jumping spiders (Araneae, Salticidae). ZooKeys 839: 1–81. <https://doi.org/10.3897/zookeys.839.28312>
- Lei H, Peng XJ (2013) Five new species of the genus *Phintella* (Araneae: Salticidae) from China. Oriental Insects 47(1): 99–110. <https://doi.org/10.1080/00305316.2013.783747>
- Li Q, Wang LY, Zhang ZX, Chen HM (2019) Two new spider species (Arachnida, Araneae) from Fanjingshan National Nature Reserve, Guizhou, China. Journal of Guangxi Normal University (Natural Science Edition) 36(4, 2018): 119–123.
- Luong PTH (2017) Taxonomic revision of Vietnamese species of the genus *Phintella* Strand (Araneae, Salticidae). Doctoral Thesis, Tokyo, 176 pp. <https://core.ac.uk/download/pdf/235010666.pdf> [accessed on 11 August 2023]
- Patoleta B (2009) Description of a new species of *Phintella* Strand in Bösenberg et Strand, 1906 from New Caledonia (Araneae: Salticidae). Genus 20: 539–543.
- Peng XJ (2020) Fauna Sinica, Invertebrata 53, Arachnida: Araneae: Salticidae. Science Press, Beijing, 612 pp.
- Peng XJ, Xie LP, Xiao XQ, Yin CM (1993) Salticids in China (Arachnida: Araneae). Hunan Normal University Press, 270 pp.
- Prajapati DA, Kumbhar SB, Caleb JTD, Sanap RV, Kamboj RD (2021) Description of two new species of the tribe Chrysillini Simon, 1901 from India (Araneae: Salticidae). Arthropoda Selecta 30(2): 230–238. <https://doi.org/10.15298/arthscl.30.2.10>
- Prószyński J (1984) Atlas rysunków diagnostycznych mniej znanych Salticidae (Araneae). Zeszyty Naukowe Wyższej Szkoły Rolniczo-Pedagogicznej w Siedlcach 2: 1–177.
- Prószyński J (1992) Salticidae (Araneae) of the Old World and Pacific Islands in several US collections. Annales Zoologici, Warszawa 44: 87–163.
- Shorthouse DP (2010) SimpleMappr, an online tool to produce publication-quality point maps. <http://www.simplemappr.net> [Accessed 11 August 2023]
- Simon E (1901) Histoire naturelle des araignées. Deuxième édition, tome second. Roret, Paris, 381–668 pp.
- Song DX, Zhu MS, Chen J (1999) The spiders of China. Hebei Science and Technology Publishing House, Shijiazhuang, 640 pp.
- Sudhin PP, Sen S, Caleb JTD (2023) New species and records in the genus *Phintella* Strand, 1906 (Araneae: Salticidae, Chrysillini) from India. Arthropoda Selecta 32(1): 80–88. <https://doi.org/10.15298/arthscl.32.1.07>
- Tyagi K, Kumar V, Kundu S, Pakrashi A, Prasad P, Caleb JTD, Chandra K (2019) Identification of Indian spiders through DNA barcoding: cryptic species and species complex. Scientific Reports 9(14033): 1–13. [+Supplement] <https://doi.org/10.1038/s41598-019-50510-8>
- Wang C, Li SQ (2020) Seven new species of jumping spiders (Araneae: Salticidae) from Xishuangbanna, China. ZooKeys 968: 43–69. <https://doi.org/10.3897/zookeys.968.55047>
- WSC (2023) World Spider Catalog. Version 23.5. Natural History Museum Bern. <http://wsc.nmbe.ch> [accessed on 13 September 2023]
- Xie LP (1993) New records of Salticidae from China (Arachnida: Araneae). Acta Scientiarum Naturalium Universitatis Normalis Hunanensis 16: 358–361.
- Żabka M (1985) Systematic and zoogeographic study on the family Salticidae (Araneae) from Viet-Nam. Annales Zoologici, Warszawa 39: 197–485.